

(12) UK Patent Application (19) GB (11) 2 118 784 A

(21) Application No 8210656
 (22) Date of filing 13 Apr 1982
 (43) Application published
 2 Nov 1983

(51) INT CL³
 H02K 5/14

(52) Domestic classification
 H2A A8
 U1S 1819 H2A

(56) Documents cited
 GB 0930979
 GB 0226160

(58) Field of search
 H2A

(71) Applicant
 General Motors France
 (France),
 56—68 Avenue Louis
 Roche, 92231
 Gennevilliers, Seine,
 France

(72) Inventors
 Daniel Delautre,
 Fernand Caillet,
 Sydney Boulakia

(74) Agent and/or Address for
 Service
 J. N. B. Breakwell,
 Patent Section, Luton
 Office (f6), PO Box No 3,
 Kimpton Road, Luton,
 Bedfordshire LU2 05Y

(54) **Brush holder assemblies for commutator brushes of electrical machines**

(57) A brush holder assembly for commutator brushes 38 of a motor comprises an annular support plate 52 formed as a sheet steel stamping, and four brush holders 40 having the form of rectangular blocks and made as one-piece mouldings from glass fibre-reinforced polyamide plastic material. Each of the plastic brush holders

has a mounting slot for the reception of an axially offset mounting portion 50 of the annular support plate. Each brush holder is positively retained in its mounted position on the support plate by means of an integral spring finger 64 extending along the base region of the brush holder and having at its free end a chamfered detent tongue which, on assembly, snaps over the outer peripheral edge region of the mounting portion of the annular support plate to lock the brush holder in position.

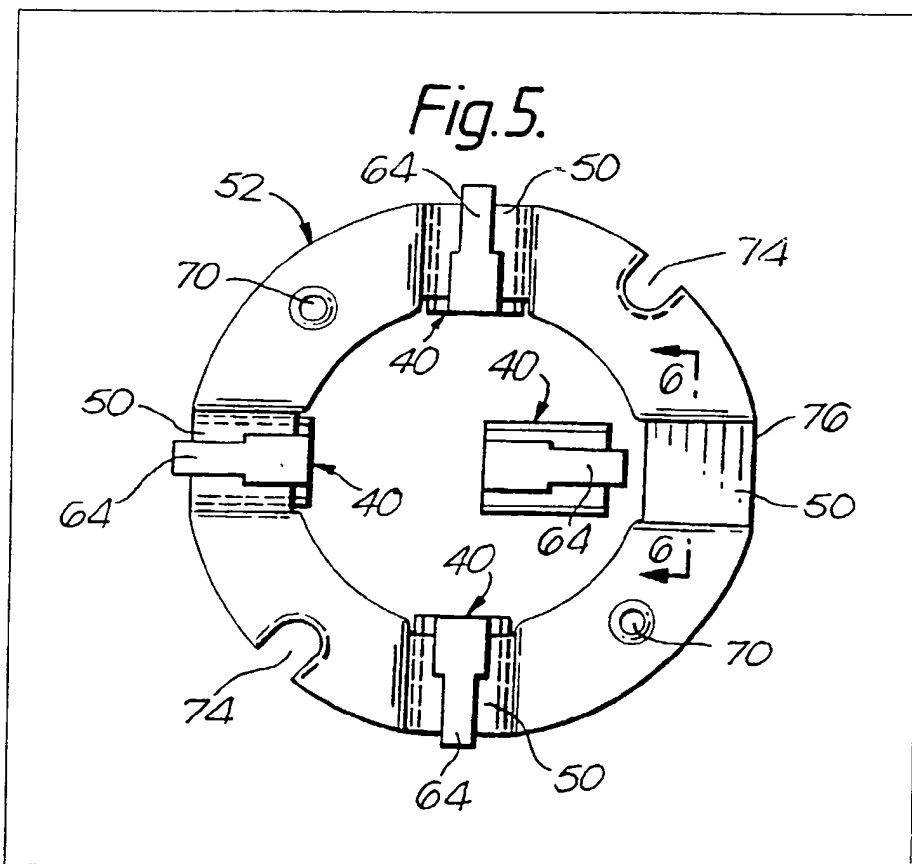


Fig. 1.

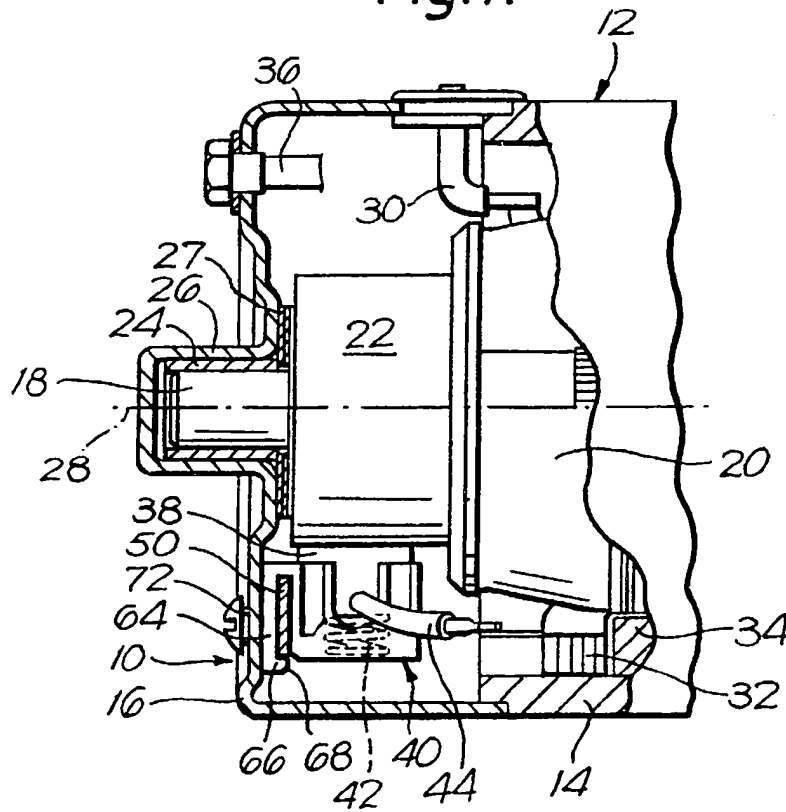


Fig. 2.

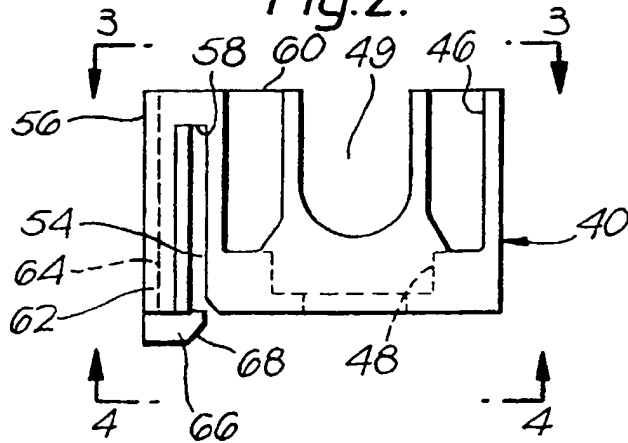
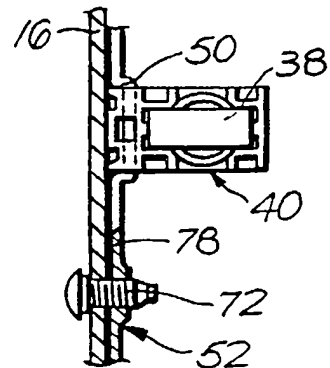


Fig. 7.



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Fig.3.

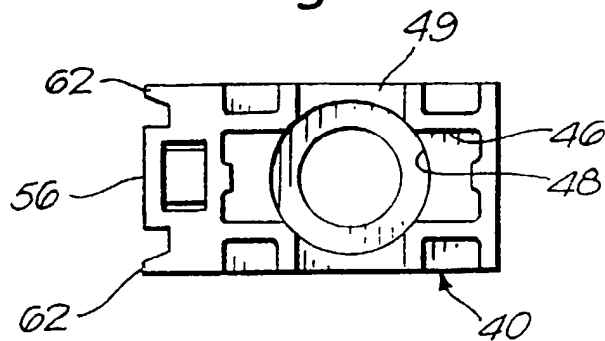


Fig.4.

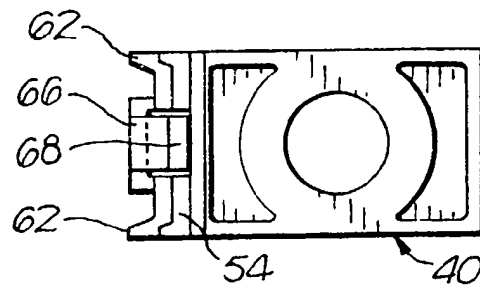


Fig.5.

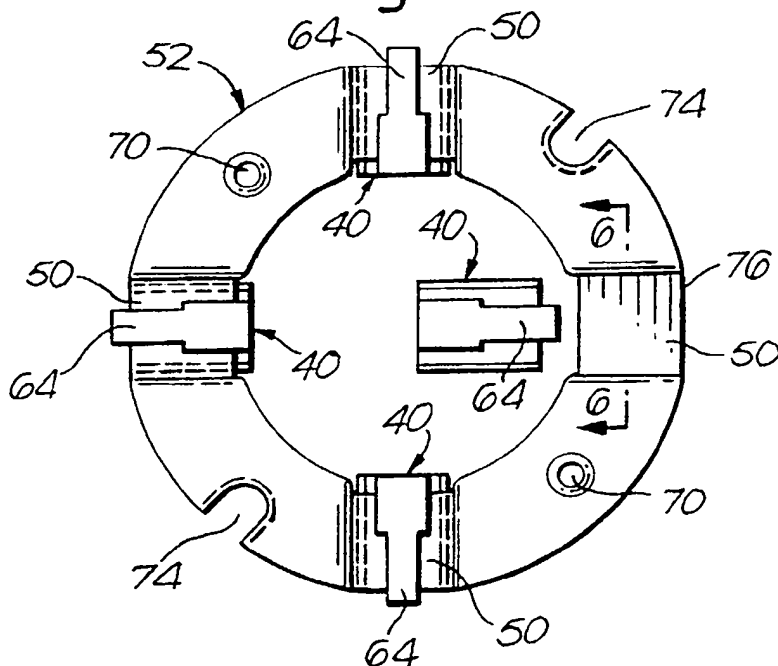
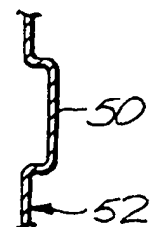


Fig. 6.



SPECIFICATION

Brush holder assemblies for commutator brushes of electrical machines

This invention relates to brush holder
5 assemblies for commutator brushes of electrical machines, for example automotive starter motors.

There is a need for a simple, reliable and easily assembled brush holder assembly for automotive starter motors and other small direct current
10 electrical machines.

By the present invention there is provided a brush holder assembly for commutator brushes of an electrical machine, comprising an annular support member adapted to be secured to a
15 housing for the commutator of the electrical machine, and a plurality of brush holders adapted to be mounted on the support member and to accommodate respective brushes engageable with the commutator, with at least one of the brush
20 holders comprising a hollow member providing a cavity therein for a resiliently biased commutator brush, the brush holder having a mounting slot for co-operation with a respective mounting portion of the support member such that the brush holder
25 may be slide into an operative position on the mounting portion of the support member, and the brush holder having adjacent the mounting slot a resilient detent member effective in the operative position of the brush holder to co-operate with the
30 support member to retain the brush holder in its operative position.

In a preferred embodiment of a brush holder assembly in accordance with the present invention, the annular support member comprises
35 an annular plate formed as a sheet metal stamping and having four equally circumferentially spaced mounting portions axially offset from the plane of the plate, and four brush holders, in the form of one-piece mouldings made from glass fibre-reinforced polyamide plastics material, held
40 securely in an operative position on the respective mounting portions of the annular support plate. Each of the brush holders has the shape of a hollow rectangular block having a body portion
45 providing a cavity for receiving a commutator brush and a biasing spring for the brush, and a base portion for co-operation with the respective mounting portion of the annular support plate. In detail, the base portion of each brush holder
50 includes a mounting slot which is disposed parallel to the base of the block and has a closed end which is parallel to the face of the block into which the brush cavity opens. Thus the brush cavity and the mounting slot extend in opposite directions,
55 such that the brush holder has a generally S-shaped overall configuration as viewed in side elevation.

The base portion of each brush holder includes a pair of parallel guide portions which effectively
60 form the base of the brush holder, and, extending between and parallel to the guide portions, in a direction generally parallel to the base of the brush holder, a resilient detent member in the form of an integral finger having at its free end a chamfered

65 upwardly extending detent tongue (latching tongue).

Each brush holder is mounted on its respective mounting portion of the support plate by the simple operation of introducing the brush holder
70 into the central region of the annular support plate, aligning the mounting slot of the brush holder with the respective offset mounting portion of the support plate, and sliding the brush holder in a radially outward direction until the detent
75 tongue snaps over the outer peripheral edge portion of the mounting portion, thereby locking the brush holder in its operative position, with the brush holder being securely held in position by co-operation between the mounting portion of the
80 annular support plate and the adjacent surfaces of the brush holder.

The resulting assembly comprising the annular support member with the four brush holders mounted thereon can thereupon be secured, as by
85 screws, to a generally flat internal base surface of a cup-shaped commutator housing, with the commutator brushes, provided with electrical connecting leads, being slidably mounted in the cavities in the brush holders at a convenient stage
90 in the assembly operation.

The overall assembly is then mated with the commutator and commutator shaft, and with the main housing part of a starter motor, and secured by bolts.

95 Disassembly if required is likewise a simple operation. The individual brush holders can readily be removed from the annular support plate by pushing down the detent tongue to permit the brush holder to be slid off the support plate in a
100 radially inward direction.

In the drawings:—

Figure 1 is a fragmentary folded longitudinal section, with parts broken away and in elevation, showing one embodiment of a brush holder
105 assembly in accordance with the present invention, as applied to an automotive starter motor;

Figure 2 is an enlarged side elevation of a brush holder forming part of the assembly shown in
110 Figure 1;

Figure 3 is an end view of the brush holder, on the line 3—3 of Figure 2, in the direction of the arrows;

Figure 4 is an end view similar to Figure 3 but on the line 4—4 of Figure 2, in the direction of the
115 arrows;

Figure 5 is an under plan view of the brush holder assembly shown in Figure 1, with one of the brush holders shown out of its operative
120 position;

Figure 6 is a fragmentary section showing a mounting portion of an annular support plate forming part the brush holder assembly, on the
125 line 6—6 of Figure 5, in the direction of the arrows; and

Figure 7 is fragmentary view, partly in section, and with a commutator omitted for clarity, illustrating a brush and brush holder in place in the assembly shown in Figure 1, viewed in a direction

radially outwardly from the centre axis of the assembly.

In the drawings, Figure 1 shows one embodiment of a brush holder assembly in accordance with the present invention, denoted generally by the reference numeral 10 in position in a starter motor 12.

The starter motor 12 is otherwise conventional, and therefore is not illustrated in detail. Broadly, the starter motor 12 has a three-part housing comprising a main housing part 14, a generally cup-shaped deep-drawn commutator end frame 16, and a drive end housing (not shown) secured to the end of the main housing part remote from the commutator end frame. A rotary drive shaft 18 carrying an armature 20 and commutator 22 is rotatably mounted in the starter motor housing by a pair of bearing brushes one 24 of which is accommodated in a hollow central boss 26 of the commutator end frame 16. A thrust washer 27 is disposed between the commutator face and a radially extending internal surface of the commutator end frame 16.

A conventional starter motor solenoid (not shown) mounted in the main housing part 14 parallel to the centre axis 28 of the drive shaft 18 is energizable to cause a lever-type shift mechanism (not shown) mounted within the drive end housing to slide a drive pinion (not shown) along the drive shaft into a position for meshing engagement with a ring gear of a vehicle engine.

Figure 1 of the drawings further shows a connector lead 30 for supplying current to rotary field coils 32 of the motor, one of a series of field poles 34 secured within the main housing part 14, and one of a pair of retaining bolts 36 for securing the commutator end frame 16 to the main housing part.

For the supply of electrical current to the commutator 22, four carbon brushes 38 are equally circumferentially spaced around the commutator 22 and are slidably mounted in respective brush holders 40 together with biasing springs 42 which bias the respective brushes in a radially inward direction into electrical contact with the commutator. Figure 1 of the drawings shows one of the brushes 38 and its biasing spring 42, and a brush lead 44.

The four brush holders 40 are of identical construction, and one of them is shown enlarged in Figures 2, 3 and 4. The brush holder 40 is a one-piece moulding made from polyamide 6.6 plastics material incorporating glass fibres for reinforcement, and has the form of a hollow rectangular block having a body portion providing a cavity 46 for accommodating the brush 38 and its biasing spring 42. The cavity 46 has a main rectangular-section portion slidably receiving the brush 38, and a smaller circular-section portion 48 forming a spring seat and guide for the biasing spring 42, as best seen in Figures 2 and 3 of the drawings. Lateral recesses 49 in the blocks permit passage of the brush leads 44.

The brush holder 40 also has a base portion for co-operation with a respective mounting portion

50 of an annular support plate 52 which is best seen in Figure 5 of the drawings, and provides a mounting for the brush holder. The base portion of the brush holder 40 includes a mounting slot 54 which is disposed parallel to the base surface 56 of the block and has a closed end 58 which is parallel to the face 60 of the block into which the cavity 46 opens. The cavity 46 and the mounting slot 54 in the brush holder 40 thereby extend in opposite directions, such that the brush holder has a generally S-shaped overall configuration as viewed in side elevation in Figure 2 of the drawings.

The base portion of the brush holder 40 also includes a pair of parallel guide portions 62 which have bevelled upper edges and also have tapered lower portions providing the base surface 56 of the block. An integral spring finger 64 extends between and parallel to the guide portions 62, in a direction substantially parallel to the base surface 56 to a position beyond the body portion of the block, the free end of the spring finger 64 having a latching tongue constituted by a detent tongue 66 which extends in a direction towards the body portion partly across the mounting slot 54, and has an inclined (chamfered) external surface 68.

The annular support plate 52 is shown in Figures 5 and 6 of the drawings as comprising a sheet steel stamping having four equally circumferentially spaced mounting portions 50 offset slightly in the axial direction from the plane of the main part of the plate. The support plate 52 is also formed with an opposed pair of screw threaded holes 70 for receiving fixing screws 72 (Figure 7), and an opposed pair of recesses 74 opening to the outer periphery of the plate to provide a free space for passage of the retainer bolts 36.

The brush holders 40 and the annular support plate 52 can readily be assembled together to provide a very effective brush holder assembly for the commutator brushes 38, with the spring fingers 64 and detent tongues 66 co-operating with the mounting portions 50 of the support plate to give very satisfactory latching of the brush holders in position.

Specifically, the brush holders 40 are mounted on their respective mounting portions 50 of the annular support plate 52 by simply introducing each brush holder in turn into the space forming the central region of the support plate (as illustrated in Figure 5 for one of the brush holders), aligning the mounting slot 54 of the brush holder with one of the offset mounting portions of the support plate, and then moving the brush holder in a radially outward direction so that co-operation between the edge region of the offset portion and the chamfered surface 68 of the detent tongue 66 cams the detent tongue to a position clear of the mounting slot, so permitting sliding of the brush holder along the offset portion radially thereof until the detent tongue snaps over the outer peripheral edge region 76 of the mounting portion, thereby locking the brush holder in its operative, mounted position. The brush holder 40 is held

securely in position by co-operation between the mounting portion 50 of the annular support plate 52 and the surfaces of the adjacent parts of the brush holder 40, notably the closed end 58 and
 5 opposed faces of the mounting slot 54, and the detent tongue 66 and the parallel bevel-edged guide portions 62 at the base portion of the brush holder.

The assembly procedure is repeated for each
 10 of the other three brush holders, and then the assembly comprising the annular support plate 52 with the four brush holders 40 securely mounted thereon can be affixed by means of the pair of fixing screws 72 to a generally flat annular
 15 internal base surface 78 of the cup-shaped commutator end frame 16. The four commutator brushes 38 can be slidably mounted in their respective brush holders 40 at a convenient stage in the assembly operation, and their brush leads
 20 44 connected up, with the overall assembly as described being mated with the commutator 22 and commutator drive shaft 18, and with the main housing part 14 for the starter motor, prior to assembly being completed by application and
 25 tightening of the retaining bolts 36.

The brush holders 40 are positively locked in position by the snap-action detent tongue portions 66 of the spring fingers 64. The configuration of the commutator end frame 16 may be such that in
 30 the assembled condition of the spring fingers 64 bear against the internal base surface 78 (or an adjacent internal surface) of the commutator end frame thereby retaining and so locking the fingers against movement in an unlatching direction, but
 35 this is not essential because the springiness of the fingers 64 is such as to ensure satisfactory retention without the need for such back-up provision.

During disassembly, the individual brush
 40 holders 40 can readily be removed from the annular support plate 52 by pushing down the respective detent tongues 66 to an unlatched position allowing the individual brush holders to be slid in a radially inward direction off the
 45 mounting portions 50 of the annular support plate.

The embodiment of the brush holder assembly in accordance with the present invention which has just been described thus involves only a small number of components, and the brush holders are
 50 maintained in their operative position without the need for separate securing means for the individual brush holders. The detent tongue of the spring finger of each brush holder provides a position interlock, and there is no possibility of
 55 undesired movement of the individual brush holders after assembly is complete.

The embodiment of the brush holder assembly as described thus meets the requirements of a simple, reliable and easily assembled brush holder
 60 assembly for automotive starter motors, and is also suitable for other small direct current electrical machines.

CLAIMS

1. A brush holder assembly for commutator

65 brushes of an electrical machine, comprising an annular support member adapted to be secured to a housing for the commutator of the electrical machine, and a plurality of brush holders adapted to be mounted on the support member and to
 70 accommodate respective brushes engageable with the commutator, with at least one of the brush holders comprising a hollow member providing a cavity therein for a resiliently biased commutator brush, the brush holder having a
 75 mounting slot for co-operation with a respective mounting portion of the support member such that the brush holder may be slid into an operative position on the mounting portion of the support member, and the brush holder having adjacent the
 80 mounting slot a resilient detent member effective in the operative position of the brush holder to co-operate with the support member to retain the brush holder in its operative position.

2. A brush holder assembly according to claim
 85 1, in which the resilient detent member comprises a resilient finger having a detent portion which in the operative position of the brush holder engages an edge portion of the support member to retain the brush holder in its operative position.

3. A brush holder assembly according to claim
 90 1, in which the resilient detent member comprises a resilient finger extending from a base portion of the brush holder and terminating in a detent tongue which, when the brush holder is slid into
 95 its operative position on the mounting portion of the support member, snaps over a peripheral edge portion of the mounting portion to lock the brush holder in its operative position.

4. A brush holder assembly according to claim
 100 3, in which the annular support member comprises an annular plate having mounting portions as aforesaid axially offset from the plane of the plate, and in the operative position of the brush holder the base portion thereof and the
 105 resilient finger are disposed substantially in the plane of the plate, with the detent tongue overlying the peripheral edge portion of the mounting portion of the annular support member.

5. A brush holder assembly according to claim
 110 3 or 4, in which the mounting slot in the brush holder has a closed end, the resilient finger extends between and parallel to a pair of parallel guide portions of the base portion of the brush holder, and in the operative position of the brush
 115 holder the closed end of the mounting slot, the parallel guide portions of the base portion, the detent tongue and opposed face of the mounting slot co-operate with the annular support member to hold the brush holder securely in position.

6. A brush holder assembly according to any one of claims 1 to 5, in which the brush holder comprises a one-piece moulding of electrically insulating plastics material.

7. A brush holder assembly according to claim
 125 6, in which the brush holder comprises a one-piece moulding made from polyamide plastics material with or without incorporated glass fibre reinforcement.

8. A brush holder assembly according to any

one of claims 1 to 7, in which the brush holder is formed with at least one lateral aperture for an electrical connecting lead for the brush.

- 5 9. A brush holder assembly according to any one of claims 1 to 8, in which the annular support member comprises a sheet metal stamping.

- 10 10. A brush holder assembly according to any one of claims 1 to 9, in which the annular support member is formed with four equally circumferentially spaced mounting portions as aforesaid for the reception of respective brush holders.

- 15 11. A brush holder assembly according to any one of claims 1 to 10, in which the annular support member is provided with apertures for the reception of securing members.

- 20 12. A brush holder assembly according to one of claims 1 to 11, in which the annular support member is secured to a generally flat internal base surface of a cup-shaped commutator housing as aforesaid.

13. A brush holder assembly according to claim

- 25 12, in which the annular support member and the commutator housing are each provided with a pair of apertures for respective electrical brush connecting leads.

- 30 14. A brush holder assembly according to claim 12 or 13, in which the commutator housing includes a central bearing mounting portion, a commutator of an electrical machine has a commutator shaft journaled in the bearing mounting portion of the commutator housing, and each of the brush holders has a respective commutator brush slidably mounted in the cavity thereof and spring-biased into engagement with the commutator of the electrical machine.

- 35 15. A brush holder assembly according to claim 14, in which the electrical machine comprises an automotive starter motor.

- 40 16. A brush holder assembly for commutator brushes of an electrical machine, substantially as hereinbefore particularly described and as shown in the accompanying drawings.